INTERNATIONAL STANDARD

ISO 4630-1

First edition
2004-11-15

Clear liquids — Estimation of colour by the Gardner colour scale —

Part 1: Visual method

Liquides clairs — Évaluation de la couleur au moyen de l'échelle Gardner —

Partie 1: Méthode visuelle

Reference number
ISO 4630-1:2004(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 4630-1 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 10, *Test methods for binders for paints and varnishes*, in collaboration with ASTM D 01.34, *Naval stores.* It has been harmonized with ASTM D 1544-98, *Standard Test Method for Color of Transparent Liquids (Gardner Color Scale)*.

It cancels and replaces ISO 4630:1997, which has been technically revised. The main changes are that the chromaticity coordinates and luminous transmittances are now used as reference standards instead of liquid standards and that the conversion procedure for glass test tubes having an inside diameter other than (10,65 ± 0,025) mm has been deleted.

ISO 4630 consists of the following parts, under the general title *Clear liquids — Estimation of colour by the Gardner colour scale*:

— *Part 1: Visual method*

— *Part 2: Spectrophotometric method*

Clear liquids — Estimation of colour by the Gardner colour scale —

Part 1:
Visual method

1 Scope

This part of ISO 4630 specifies a method for estimating, by means of the Gardner colour scale, the colour of clear, yellow/brown liquid products using colour-measuring instruments. The results might be invalid if other products are tested.

It is applicable to drying oils, varnishes and solutions of fatty acids, polymerized fatty acids, resins, tall oil, tall oil fatty acids, rosin and related products.

It is applicable to products having colours from Gardner 1 to Gardner 18. The Gardner scale is not applicable to products with colours lighter than 1 or darker than 18.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

CIE Publication No. 15.2, *Colorimetry*

3 Principle

The colour of a sample of the product under examination is viewed in a glass tube of standard diameter and visually compared with the colours of arbitrarily numbered colour standards. The standard that most closely matches the colour of the test sample is identified and the result is expressed in terms of a number on the Gardner colour scale.

4 Apparatus and materials

4.1 Gardner colour standards.

4.1.1 Reference standards

The chromaticity coordinates and luminous transmittances specified in Table 1 are required as reference standards for calibration.

Colour standards that do not conform to the requirements in Table 1 shall be rejected.

Table 1 — Colour specifications for reference standards

Gardner colour standard number	Chromaticity coordinates		Luminous transmittance, Y	Tolerance on transmittance
	x	y	%	$(\pm)$ %
1	0,317 7	0,330 3	80	7
2	0,323 3	0,335 2	79	7
3	0,332 9	0,345 2	76	6
4	0,343 7	0,364 4	75	5
5	0,355 8	0,384 0	74	4
6	0,376 7	0,406 1	71	4
7	0,404 4	0,435 2	67	4
8	0,420 7	0,449 8	64	4
9	0,434 3	0,464 0	61	4
10	0,450 3	0,476 0	57	4
11	0,484 2	0,481 8	45	4
12	0,507 7	0,463 8	36	5
13	0,539 2	0,445 8	30	6
14	0,564 6	0,427 0	22	6
15	0,585 7	0,408 9	16	2
16	0,604 7	0,392 1	11	1
17	0,629 0	0,370 1	6	1
18	0,647 7	0,352 1	4	1

4.1.2 Working standards

Used as working standards are 18 glass or liquid standards having chromaticity coordinates that differ from those of reference standards by not more than one-third of the difference in x or y (see Table 1) between adjacent reference standards.

In any one set of working standards, no two standards shall be closer together than two-thirds of the difference in x or y between the corresponding reference standards.

The luminous transmittance shall be as specified in Table 1.

In cases of dispute, only reference standards (4.1.1) shall be used.

The standards shall be mounted in such a way that they can be conveniently handled and allow simultaneous viewing of two adjacent standards in the colour comparator (4.3).

When using liquid working standards — coloured solutions contained in glass tubes (4.2) — they shall be checked by the method specified in Annex A.

Potassium hexachloroplatinate(IV) solutions are used for the lighter standards (1 to 8), and solutions of iron(III) chloride and cobalt(II) chloride in hydrochloric acid are used for the darker standards (9 to 18).

The compositions of the liquid standards are specified in Annex B.

4.2 Glass test tubes, clear, colourless, round, preferably of inside diameter $(10{,}650 \pm 0{,}025)$ mm, outside diameter about 12,5 mm and outside length about 114 mm.

4.3 Colour comparator, providing uniform illumination and permitting simultaneous visual comparison of light transmitted through two colour standards and through a sample in a test tube in the transverse direction.

The apparatus may be of any design but shall have the following characteristics:

4.3.1 Illumination

CIE illuminant C.

4.3.2 Surrounding field

The surrounding field shall not differ significantly in brightness from the samples and standards and shall be essentially achromatic.

4.3.3 Field of view

The field of view shall be wide enough to enable two standards and a test sample to be viewed.

4.3.4 Arrangement of standards and sample

There shall be a perceptible gap between the test sample and each standard, but this shall be as small as possible.

5 Sampling

Take a representative sample of the product to be tested, as described in ISO 15528.

6 Procedure

If the material shows any visual haziness, remove the haze by filtration, centrifugation, heating, ultrasonic treatment or any other suitable means (see Note).

If the haziness cannot be removed, the measured value will be unreliable and too high, and therefore unusable.

Fill a clean test tube (4.2) to a height of at least 70 mm with a test sample. Avoid creating air bubbles when filling the tube. If air bubbles are formed and remain trapped, remove them by heating, vacuum, ultrasonic treatment or any other suitable means (see Note).

NOTE Some sample pretreatments can change the colour.

Place the test tube with the test sample in the sample compartment of the colour comparator (4.3). Switch on the light source and compare simultaneously the colour of the test sample with the colours of two adjacent standards, at a viewing distance of between 30 cm and 50 cm.

Determine which standard most closely matches the test sample in colour, ignoring any differences of hue.

7 Expression of results

Express the colour of the test sample as the number of the Gardner colour standard most closely matching the colour of the test sample. If more precise colour numbers are needed, report as lighter than, matching or darker than the standard, for example report as 5, 5+, 6− or 6 if the colour of the test sample is between 5 and 6.

8 Precision

8.1 Repeatability limit (r)

The repeatibility limit r is the value below which the absolute difference between two single test results, each the mean of duplicates, can be expected to lie when this method is used under repeatability conditions, i.e.

when the test results are obtained on identical material by one operator in one laboratory within a short interval of time using the standardized test method. For this method, r is 1 colour number, with a 95 % probability.

8.2 Reproducibility limit (R)

The reproducibility limit R is the value below which the absolute difference between two single test results, each the mean of duplicates, can be expected to lie when this method is used under reproducibility conditions, i.e. when the test results are obtained on identical material by operators in different laboratories using the standardized test method. For this method, R is 2 colour numbers, with a 95 % probability.

9 Test report

The test report shall contain at least the following information:

a) a reference to this part of ISO 4630 (ISO 4630-1);

b) all details necessary to identify the product examined;

c) whether glass standards or liquid standards were used;

d) whether any pretreatment of the product was necessary;

e) the result of the test as indicated in Clause 7;

f) any deviation from the test method specified;

g) the date of the test.

Annex A
(normative)

Calculating chromaticity coordinates for Gardner colour standards

A.1 Select a dual-beam spectrometer with a sufficiently narrow light beam at the sample position so that all rays pass through the standards to be checked. If this is not the case, equip the spectrometer with a condensing lens to achieve this.

A.2 Place the standards in turn in the sample position of the spectrometer. If the colour comparator is provided with a separate green filter in front of the light source, place this filter in the reference beam of the dual-beam spectrometer during calibration of each standard.

A.3 Obtain spectral transmittance values for each reference standard by following the procedure given in CIE Publication No. 15.2.

A.4 From the spectral transmittance values for each standard, calculate the CIE tristimulus values X, Y, Z and the chromaticity coordinates x, y for CIE illuminant C/2°, using the procedure specified in CIE Publication No. 15.2.

Annex B
(normative)

Liquid Gardner colour standards

B.1 Reagents

In preparing these standards, use only reagents of recognized analytical grade and only water of at least grade 3 purity as defined in ISO 3696.

B.1.1 **Hydrochloric acid**, diluted 1 + 17.

Mix 1 volume of concentrated hydrochloric acid, 38 % (by mass), $\rho = 1{,}19$ g/ml, with 17 volumes of water.

B.1.2 **Potassium hexachloroplatinate solution**.

Dissolve 790 mg of potassium hexachloroplatinate (K_2PtCl_6) in diluted hydrochloric acid (B.1.1) in a 100 ml one-mark volumetric flask. Warm the solution until all the potassium hexachloroplatinate has dissolved. Cool to 20 °C, dilute to the mark with the same hydrochloric acid and mix well.

B.1.3 **Cobalt(II) chloride solution**.

Dissolve 40 g of cobalt(II) chloride hexahydrate ($CoCl_2 \cdot 6H_2O$) in 120 g of diluted hydrochloric acid (B.1.1).

B.1.4 **Iron(III) chloride solution**.

Dissolve 1 000 g of iron(III) chloride hexahydrate ($FeCl_3 \cdot 6H_2O$) in 240 g of diluted hydrochloric acid (B.1.1), heating gently if necessary. Adjust the concentration so that the solution has exactly the same colour as a freshly prepared 30 g/l solution of potassium dichromate ($K_2Cr_2O_7$) in concentrated sulfuric acid ($\rho = 1{,}84$ g/ml). Determine the colour by spectrometer.

B.2 Preparation of liquid colour standards

B.2.1 Gardner colour standards 1 to 8

Into each of a series of one-mark volumetric flasks of the capacities indicated in Table B.1, transfer from a microburette the volume of potassium hexachloroplatinate solution (B.1.2) shown in Table B.1, make each up to the mark with diluted hydrochloric acid (B.1.1) and mix well.

Table B.1 — Composition of Gardner colour standards 1 to 8

Gardner colour standard number	Volume of potassium hexachloroplatinate solution ml	Volume of volumetric flask ml
1	3,48	50
2	5,47	50
3	8,42	50
4	6,58	25
5	9,60	25
6	5,35	10
7	8,10	10
8	10,00	10

B.2.2 Gardner colour standards 9 to 18

Into a series of 100 ml one-mark volumetric flasks, introduce from burettes the volumes of iron(III) chloride solution (B.1.4) and cobalt(II) chloride solution (B.1.3) shown in Table B.2. Make each up to the mark with diluted hydrochloric acid (B.1.1) and mix well.

Table B.2 — Composition of Gardner colour standards 9 to 18

Gardner colour standard number	Volume of iron(III) chloride solution ml	Volume of cobalt(II) chloride solution ml	Volume of hydrochloric acid ml
9	3,8	3,0	93,2
10	5,1	3,6	91,3
11	7,5	5,3	87,2
12	10,8	7,6	81,6
13	16,6	10,0	73,4
14	22,2	13,3	64,5
15	29,4	17,6	53,0
16	37,8	22,8	39,4
17	51,3	25,6	23,1
18	100,0	0,0	0,0

B.2.3 Storage

Gardner colour standards are stable for 6 months when stored in the dark but should preferably be prepared immediately before use.

ICS 87.060.20

Price based on 7 pages